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# *CALL teacher education as an impetus for L2 teachers in integrating technology*

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**Abstract**

The ultimate goal of CALL teacher education is to enable L2 teachers to integrate CALL technology into their classroom with confidence and knowledge. As a way to achieve this goal, an increasing number of studies have paid attention to the integration of CALL technology into the teacher education program and into the classroom. Nonetheless, there is little specific research into L2 teachers' integration of technology into the classroom in relation to their prior technology education. As a means of better understanding the complexity of L2 teachers' integration of technology into the classroom, this paper proposes a spherical model of such integration by reviewing and synthesizing the relevant literature. Drawing on this model, the paper emphasizes the importance of CALL teacher education with regard to L2 teachers' integration of technology into the classroom. Next, it discusses how the model can contribute to future research on such integration.

Keywords: CALL teacher education, CALL integration, second language (L2) education

> *Computers have been oversold and underused, at least for now.* (Cuban, 2001: 179)

## 1 Introduction

With the *mise en scène* of foreign and second language (L2) education changing into the technology-enhanced L2 classroom (cf., Grenfell *et al*., 2003: 17–197; Meskill *et al*., 2006a; Parsad & Jones, 2006), increasing attention has been paid to Computer-Assisted Language Learning (CALL) teacher education in recent years (cf., Hubbard & Levy, 2006b; Kassen *et al*., 2007). The ultimate goal of CALL teacher education is to enable L2 teachers to integrate CALL technology into their classroom with confidence and knowledge. Thus, L2 researchers and teacher educators are particularly concerned with L2 teachers' integration of CALL technology into the classroom in relation to their CALL technology education experience. While there is a large array of research on CALL teacher education and L2 teachers' technology integration into the classroom (see *Language Learning & Technology* 6 (3); Hubbard & Levy, 2006b; Kassen *et al*., 2007), L2 researchers and teacher educators continue

to be confronted by the question of whether L2 teachers' prior technology education serves to foster their use of computer technology in the classroom.

Previous studies on CALL teacher education do not provide a definitive answer to the question; rather, their findings indicate numerous factors that are involved in the process of L2 teachers' use of computer technology in the classroom (e.g., Egbert *et al*., 2002; Lam, 2000; Meskill *et al*., 2002; Meskill *et al*., 2006a). After reviewing and synthesizing the relevant literature,[1] this paper discusses the complex nature of L2 teachers' integration of technology into the classroom and proposes a spherical model as a means of understanding this complexity. The paper concludes with a discussion of how the model can contribute to future research on L2 teachers' integration of technology.

## 2 Review of literature

### *2.1 Why CALL teacher education?*

In the discussion of theory and practice in L2 teacher education, Johnson (1996: 766) states that "the problems that teachers face are generally caused by constraints imposed on them within the social, cultural, economic, and educational contexts in which their practice takes place, namely, the school and classroom". While the problems are not mainly caused by the constraints in terms of CALL, L2 teachers have faced a parallel problem over the past decades, brought about by vicissitudes around L2 teachers in the school and classroom (cf., Chapelle, 2001: 1–44; Kassen & Higgins, 1997; Kern *et al*., 2004). In particular, people in and outside the school setting are connected through Information and Communication Technology (ICT) beyond temporal and spatial boundaries (cf., White, 2006); students participate in virtual communities to meet and communicate with people from all over the world, and create their own culture in communication and collaboration (cf., Thorne & Payne, 2005); personal computers equipped with ICT are commonly available in and out of the classroom, making paper-based materials and analog audio/video equipment obsolete in the L2 classroom (cf., Mishan, 2005: 241–282); and a considerable number of CALL research studies suggest the efficacy of computer technology on L2 teaching and learning (cf., Blin, 2004; Chun & Plass, 1996; Ducate & Lomicka, 2005; Kern, 1995; Warschauer & Kern, 2000).

Responding to these problems that confront L2 teachers, L2 researchers and teacher educators often ask, 'How can such a changing milieu (e.g., the technology-enhanced L2 classroom) be successfully integrated into L2 instruction?' How L2 researchers and teacher educators deal with the question is apparent in how the focus of research has changed in the CALL literature over several decades.

[1] The literature review in this paper is primarily based on the following sources: (1) recently edited volumes about CALL teacher education (Kassen *et al*., 2007; Hubbard & Levy, 2006b); (2) four major journals in the field of CALL and language teaching and learning from 2000 through 2007 (*Language Learning & Technology*, *CALICO Journal*, *ReCALL*, *Computer Assisted Language Learning*); (3) three major journals in the field of educational technology, devoted to technology and teacher education, from 2000 through 2007 (*Journal of Technology and Teacher Education*, *Journal of Research on Technology in Education*, and *Journal of Information Technology for Teacher Education*).

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As Beatty (2003: 14) notes, the research focus in the CALL literature has shifted from whether to use computer technology for L2 education to "*how* computers should be used [and] *for what purposes*". And, by extension, as a way of achieving successful use of CALL technology for instructional purposes, both L2 researchers and teacher educators emphasize L2 teachers' readiness for the use of CALL technology in the classroom (Hubbard, 2008; Hubbard & Levy, 2006b; Kassen *et al*., 2007), whilst also acknowledging the importance of learners' readiness for the use of CALL technology (Hubbard, 2004; Stockwell & Levy, 2001).

The underlying reason for emphasizing L2 teachers' readiness with regard to the successful implementation of CALL technology in the classroom is that "forethought and preparation can help many possible problems" attributed to the presence of computer technology in the classroom (Levy & Stockwell, 2006: 203). Hubbard (2008: 176) expresses this in a more practical sense:

> The future of CALL is closely tied to the future of language teacher education because language teachers are pivotal players: they select the tools to support their teaching and determine what CALL applications language learners are exposed to and how learners use them.

In addition, rapidly changing CALL technology and the widening scope of technology-enhanced environment place more weight on the significance of L2 teachers in order to successfully implement computer technology in the L2 classroom (e.g., Godwin-Jones, 2002, 2003; Hong & Samimy, forthcoming). Moreover, unlike L2 teachers working in the traditional classroom, those in the technology-enhanced environment are even expected to be able to "understand frameworks for evaluating CALL in its many forms" as they use computer technology in the classroom; in other words, "they need to know why they do what they do" (Hubbard & Levy, 2006a: 11).[2] In the technology-enhanced L2 teaching and learning environment, it behoves L2 teachers to surmount the integration of computer technology into the classroom; and the optimal way to achieve this is for L2 teachers to experience and become familiar with the use of available CALL technologies during their teacher education (Hubbard & Levy, 2006b; Hughes, 2005; Kassen *et al*., 2007).[3]

### 2.2 CALL teacher education for pre- and in-service teachers

In a survey study about the use of computer technology in the classroom by K-12 teachers working in schools located in the most high-tech region of the nation, namely Silicon Valley, Hernández-Ramos (2005) found that teachers' prior experience of technology in a teacher education program is positively associated with their use of technology in the classroom. This finding is in line with what Lam (2000) found in the context of L2 teachers' use of computer technology in the classroom.

[2] See also Hubbard and Levy (2006a: 5–9) for a brief overview of recent trends in CALL teacher education.

[3] The importance of technology education for teachers is also recognized in earlier studies in the field of educational technology (e.g., Chin & Hortin, 1994). For an earlier study discussing the direction in which CALL teacher education gravitates, see Levy (1997).

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Grounded in qualitative data from interviewing L2 in-service teachers, her study found that teachers' lack of knowledge about using computers and lack of training for integrating computer technology into the classroom were related to their reluctance to use computer technology in the classroom. These findings empirically espouse the growing attention in teacher education programs to enabling L2 teachers to have the wherewithal to attend to computer technology for L2 teaching and learning. In fact, several national guidelines for teacher education reflect this concern.

Having reviewed national guidelines for teacher education such as National Council for Accreditation of Teacher Education (NCATE), National Board of Professional Teaching Standards (NBPTS), National Education Technology Standards for Teachers (NETS-T), Teacher Education Accreditation Council (TEAC), and No Child Left Behind (NCLB), Oxford and Jung (2007: 29) conclude that the guidelines include a "strong basis for technology integration, both in teacher education programs and in P-12 public schools". The increasing attention to L2 teachers' technology education and the national guidelines concerning technology integration notwithstanding, several researchers note that there is still an insufficient number and quality of courses and workshops that integrate technology education into L2 teacher education programs (cf., Hubbard, 2008; Kessler, 2006; Oxford & Jung, 2007). Nonetheless, continuing efforts have been made to develop and integrate CALL teacher education into L2 teacher education programs.

The variety of these efforts is well represented in a wide range of the forms and designs of CALL teacher education in L2 teacher education programs. These include online courses along with face-to-face courses (e.g., Bauer-Ramazani, 2006; Davies, 2003; Jones & Youngs, 2006), introduction of computer technology as part of an L2 teacher education course (e.g., Desjardins & Peters, 2007; Kamhi-Stein, 2000), technology workshops (e.g., Rickard *et al.*, 2006), a series of courses offered throughout the teacher education programs (e.g., Luke & Britten, 2007), and even courses specifically designed for a CALL certificate and a CALL graduate degree (e.g., Partridge, 2006; Slaouti & Motteram, 2006). These endeavors are worthwhile because they serve to provide a better understanding of how such courses influence future and current L2 teachers with regard to the use of CALL technology; they also inform other L2 researchers and teacher educators about making better plans for context-specific parallel courses by showing the pros and cons in the already-administered courses.

The most noticeable benefits of CALL teacher education in teacher education programs include the following: CALL technology courses serve to assist L2 teachers in gaining confidence in using computer technology (e.g., Hegelheimer, 2006; Hoven, 2007; Peters, 2006; Wetzel & Chisholm, 1998) as well as having a positive attitude toward computer technology (e.g., Kamhi-Stein, 2000; Kassen & Higgins, 1997; van Olphen, 2007). Teachers' confidence in using CALL technology is the necessary first step toward expanding their knowledge of how to harness the pedagogical potential of CALL technology. Grounded in the responses of English as a Second Language (ESL) and bilingual teacher candidates to pre- and post-technology-integrated course project surveys, for example, Wetzel and Chisholm (1998) found that the course gave pre-service ESL and bilingual teachers confidence in using computer technology for their future classroom instruction. Examining L2 pre-service teachers'

technological competencies through a technology course in a 4-year teacher education program, Peters (2006) also reported that the overall competencies of the pre-service teachers taking the course were improved. Hegelheimer (2006) even argued for the early exposure of pre-service L2 teachers to a technology course offered in the beginning of a teacher education program, so that pre-service L2 teachers were able to hone their knowledge and skills obtained from the technology course by incorporating them into what would be learned from other L2 teaching courses throughout the teacher education program. His findings suggest that such an attempt contributes to enhancing students' computer literacy skills, resulting in more confidence in using web resources and evaluating computer technology for instructional purposes. Along similar lines, Hoven (2007) took an evolutionary approach to developing a technology course, continuously reflecting on students' feedback from previous courses; this eventually helped practising L2 teachers familiarize themselves with web-based technologies (e.g., WebQuest, Blog, and Wiki) which, in turn, enhanced student teachers' competencies and confidence in using the technologies in their future classes.

In addition to the enhancement of L2 teachers' confidence and competencies in using CALL technology, research studies indicate that both pre- and in-service L2 teachers' CALL technology education positively affects L2 teachers' attitude toward the use of CALL technology. Introducing a thoughtfully designed Language Learning Technology (LLT) module to graduate teaching assistants (GTAs) of a foreign language department, Kassen and Higgins (1997) reported how the GTAs' familiarity and comfort with computer technology contributed to their successful application of computer technology for instructional purposes. Similarly, Kamhi-Stein (2000) employed a computer mediated communication (CMC) mode (i.e., web-based bulletin board) in a TESOL methods course in a graduate program as a means of providing pre-service teachers with an opportunity to build their knowledge about CMC modes by learning through them. The findings of her study, based on students' responses, suggest that with their own experience of using the CMC modes as learners, the pre-service L2 teachers considered the CMC mode a useful tool for peer communication and collaboration, leading to their positive attitude toward CMC technology. In much the same way, world language teacher candidates in van Olphen's (2007) study acquired a positive attitude toward integrating computer technology in their future teaching by learning to develop digital portfolios through using a web-based system, WebCT. This review of a small body of selected studies in the literature highlights teachers' confidence and positive attitude as notable benefits of CALL teacher education. However, it is also important to note that issues concerning teachers' confidence in and attitude toward computer technology frequently emerge from studies both on the integration of computer technology into the teacher education program and on teachers' integration of computer technology into the classroom, and appear routinely in the literature in the fields of CALL teacher education (cf., Desjardins & Peters, 2007; Kessler, 2007; Olesova & Meloni, 2006; Wong & Benson, 2006) and educational technology (cf., Christensen, 2002; Mumtaz, 2000; Penuel, 2006; Russell *et al.*, 2003).

Despite the benefits of integrating CALL technology into the teacher education program for L2 teachers, several researchers are wary of the efficacy of

introducing only one or two CALL technology courses or workshops during the teacher education program (Desjardins & Peters, 2007; Kessler, 2006; Luke & Britten, 2007; Peters, 2006).[4] They do not consider a small number of courses or workshops sufficient for L2 teachers to experience a variety of CALL technology and to understand the pedagogical potential of CALL technology; and they do not believe that a small numbers of courses or workshops can contribute, as expected, to L2 teachers' use of computer technology in the classroom. Several attempts have been made to resolve this problem: (1) providing multiple opportunities for L2 teachers to experience CALL technology through a series of courses throughout the teacher education program (e.g., Luke & Britten, 2007); (2) designing a CALL technology course that reflects the verisimilitude of the actual L2 classroom environment where L2 teachers actually integrate technology (e.g., Chao, 2006; Debski, 2006; Egbert, 2006); (3) establishing a community of practice for promoting the collaboration of L2 teachers during or after their formal technology education (e.g., Arnold *et al.*, 2007; Hanson-Smith, 2006; Kolaitis *et al.*, 2006; Meskill *et al.*, 2006b); and (4) supporting L2 teachers' continuous learning about CALL technology by themselves (e.g., Robb, 2006; Szendeffy, 2005). These attempts lend themselves naturally and logically to L2 teachers' attainment of ''technopedagogical skills'' Desjardins & Peters, 2007: 6).[5] Nevertheless, L2 researchers and teacher educators still face a substantive question of whether such efforts (e.g., single or multiple CALL technology courses, situation-based and project-based CALL courses, and L2 teachers' collaboration through a community of practice) promote L2 teachers' use of computer technology in the classroom.

### *2.3 CALL technology education and L2 teachers' technology integration*

With CALL teacher education burgeoning in L2 teacher education programs, attention has been paid, without doubt, to the efficacy of such efforts; that is to say, whether L2 teachers' experience of CALL technology education fosters their use of computer technology in the classroom. Based on the responses of 108 graduates of TESOL master's degree programs to a web-based survey about formal and informal technology education, Kessler (2007) remarks that while TESOL professionals seem to feel confident about CALL technology, they do not show much confidence about integrating it into their classroom instruction. This finding clearly indicates a discrepancy between what teachers learned from technology education and how much they are able to integrate it into their classes. Although teachers' integration of technology can be defined differently depending upon their subject area and

[4] Researchers in the field of educational technology are also concerned with this issue. Hargrave and Hsu (2000), for example, found through a survey of instructional technology courses that most institutions offered a single course for pre-service teachers. Gillingham and Topper (1999) pointed out the short-term nature of such a single course approach with regard to teachers' use of computer technology.

[5] Tochon and Black (2007: 296) propose a similar notion, ''technopedagogy,'' referring to ''pedagogically appropriate technology integration''.

pedagogical purposes, the following operational definition of it was offered by the Technology in Schools Task Force (2003):

> [Integrating computer technology is] the incorporation of technology resources and technology-based practices into the daily routines, work, and management of schools. Technology resources are computers and specialized software, network-based communication systems, and other equipment and infrastructure. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods. This definition is not in itself sufficient to describe successful integration: it is important that integration be routine, seamless, and both efficient and effective in supporting school goals and purposes.[6]

This definition satisfactorily covers, albeit generically, the context of L2 teachers' integration of technology. In fact, a small body of literature looks into L2 teachers' integration of computer technology into the classroom in relation to their previous technology education experience within the boundary of the definition (e.g., Egbert *et al*., 2002; Lam, 2000; Meskill *et al*., 2006a; Meskill *et al*., 2002; Moore *et al*., 1998).

Through a statewide survey research in which about 400 L2 teachers participated across 100 school districts, Moore *et al*. (1998) explored L2 teachers' use of computer technology for instructional purposes. They attributed the fact that teachers made little use of CALL technology (e.g., the Internet, e-mail, and CD-ROM) in their instruction to their lack of knowledge about how to use CALL technology in the classroom, further emphasizing the importance of CALL technology education for both pre- and in-service L2 teachers. Looking more closely into the L2 classroom settings through the teachers' eyes and voices, Lam (2000) examined the reasons behind teachers' decisions whether to use computer technology in the classroom, and the factors that influenced those decisions. Supporting the findings of Moore *et al*. (1998), Lam also found that teachers' lack of training in the use of computers in language teaching was one of the primary factors that obstructed their decision to use computer technology. Lam (2000) noted additional factors that influenced the teachers' decisions, such as their computer literacy skills, technology resources in the school, and a shortage of preparation time for instruction with computer technology. Extending these previous studies, Meskill *et al*. (2002) examined L2 teachers' use of computer technology in relation to their former technology training by focusing on the contrast between novice and experienced teachers. The findings of the study showed that the novice teachers, even if they had received formal technology training, felt less comfortable in using computer technology for their classroom instruction than did the experienced teachers with no, or relatively little, formal technology training. Based on the findings, Meskill and her colleagues (2002: 54) further postulated that "[formal technology training] may not be sufficient for the needed conceptual development that leads to the kinds of ease and repertoire characteristics of expert users [teachers who have more teaching experience and who use computer

[6] The original article is available at http://nces.ed.gov/pubs2003/tech_schools/chapter7.asp without page numbers. The quote is taken from the section entitled "Defining Technology Integration."

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technology]". In addition, based on statewide survey responses of 847 L2 teachers on their use of computer technology in the classroom, Meskill *et al.* (2006a) reported lack of time and technology resources, lack of technology training, and lack of support from the school as hindrances to the teachers' use of computer technology for instructional purposes.

Rather than providing a definitive answer to the question of whether L2 teachers' technology education contributes to their integration of computer technology into the classroom, the findings of the above-mentioned studies bring into view the complicated and protean nature of L2 teachers' integration of computer technology into the classroom. Such multi-dimensional aspects of L2 teachers' use of computer technology are further reinforced by many studies in educational technology, which find numerous variables involved in teachers' use of computer technology for their instructional purposes. In their extensive reviews of the literature on teachers' integration of computer technology, Mumtaz (2000) and Penuel (2006) reported factors that influence teachers' use of computer technology in the classroom, such as their formal technology training experience, their attitude toward computer technology, and the availability of technology resources and technical support in the school. Similar research findings are recounted, including teachers' attitude toward computer technology (Russell *et al.*, 2003); teachers' computer literacy skills (Scheffler & Logan, 1999); availability of technology infrastructure and resources (Norris *et al.*, 2003; Pelgrum, 2001); lack of support from the school (Weikart & Marrapodi, 1999); and teachers' demographic characteristics – e.g., age, gender, years of teaching experience, years of technology use, and school workload (Becker, 1994; Wozney *et al.*, 2006).

The findings of previous studies make it a more formidable challenge for L2 researchers and teacher educators to pursue the substantive question of whether L2 teachers' experience of technology education serves to foster their use of computer technology in the classroom. Yet, they contribute to our conceptual understanding of what happens in the process of L2 teachers' use of computer technology in the classroom by shedding light on multi-dimensional aspects of teachers' integration of computer technology. In addition, such findings allow us to discern seemingly indiscrete variables involved in L2 teachers' integration of technology, so that we can conceive of them as distinct sets of factors. In other words, embracing the outwardly fragmented variables can lead to a fresh insight into L2 teachers' integration of computer technology pertaining to their experience of technology education. In this sense, it is possible to glean from previous research three categorized factors: CALL teacher education, teachers' individual factors, and contextual factors. These three categories not only capture the quintessence but also summarize the process of L2 teachers' integration of computer technology into the classroom. While the importance of these factors cannot be placed, with absolute certainty, in a sequential order, previous studies suggest that well-organized and well-prepared CALL technology education is considered to be relatively more salient to teachers' integration of technology than teachers' individual factors and contextual factors (Hubbard, 2008; Hubbard & Levy, 2006b; Kassen *et al.*, 2007).

This point is graphically illustrated in Figure 1, which presents a spherical model of L2 teachers' integration of technology into the classroom. The sphere has three orbital factors influencing it: CALL teacher education, teachers' individual factors, and contextual factors. CALL teacher education is orbiting around the equator (i.e.,

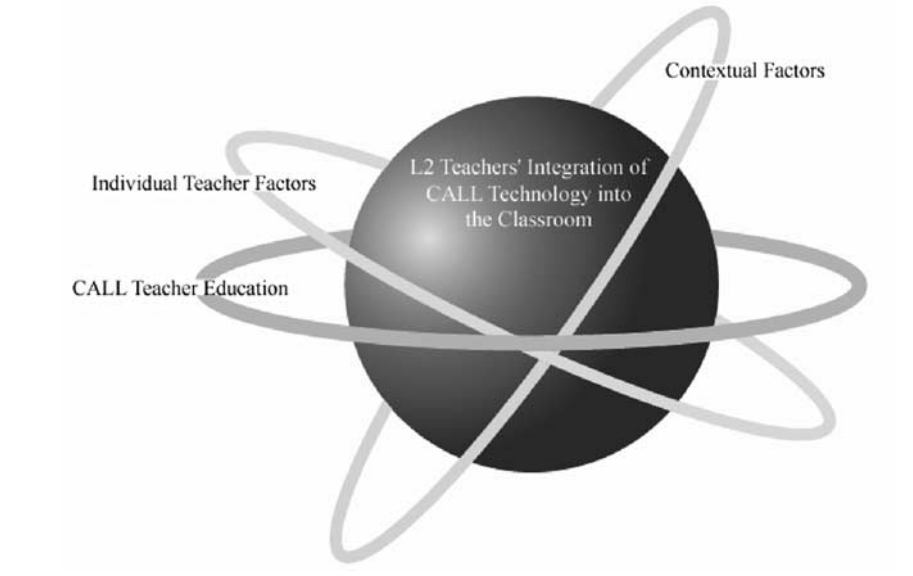


Fig. 1. The spherical model of L2 teachers' integration of CALL technology into the classroom

the center of the sphere), which indicates the relative importance to L2 teachers' technology integration compared to teachers' individual factors and contextual factors. Teachers' individual factors are orbiting slightly above the orbit of CALL teacher education, whereas the orbit of the contextual factors is further away from that of CALL teacher education. The proximity between CALL teacher education and teachers' individual factors indicates that CALL teacher education, as also shown in the review of the literature, is likely to influence teachers' individual factors (e.g., L2 teachers' general computer literacy skills or teachers' attitude toward and confidence in computer technology). The orbit of contextual factors is further away from that of CALL teacher education, in that contextual factors are relatively independent of CALL teacher education; for instance, lack of computers in and little support from the school where L2 teachers work has nothing to do with CALL teacher education. Possible ways to reduce the distance between the two orbits (i.e., to bridge the gap between CALL teacher education and the actual situations in the schools and classrooms where teachers use computer technology) can be found in the attempts that several researchers have made. These include: continuous technology education for pre- and in-service teachers (e.g., Luke & Britten, 2007; Olesova & Meloni, 2006; Robb, 2006); formal technology education reflecting actual classroom situations (e.g., Chao, 2006; Debski, 2006; Egbert, 2006); and community of practice encouraging collaboration among teachers (e.g., Arnold *et al*., 2007; Hanson-Smith, 2006; Kolaitis *et al*., 2006; Meskill *et al*., 2006b).[7]

[7] For an extensive discussion of professional development of teachers' technology integration, see also Lawless and Pellegrino (2007).

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## 3 The spherical model as an impetus for future studies

Based on the findings of previous studies, the synthesized representation of the spherical model shows more lucidly and simply the complexity involved in the process of L2 teachers' technology integration. Notwithstanding its appeal, however, the model in itself does not provide an answer to the question of whether L2 teachers' technology education experience fosters their use of computer technology in the classroom; in other words, it does not indicate whether L2 teachers with more technology education experience use computer technology more frequently in the classroom. How can the synthesized findings be consolidated to help further pursue the question, given that the ultimate goal of CALL technology education for L2 teachers is to foster their use of computer technology in the classroom? Although this is a thorny undertaking, one possibility would be to use the synthesized findings as the impetus to extend previous studies on L2 teachers' technology integration by addressing their limitations.

Previous studies on L2 teachers' technology integration are limited methodologically, analytically, and contextually. First, in terms of methodology, most of them are based on qualitative research methods using a small sample (e.g., Egbert *et al*., 2002; Lam, 2000; Meskill *et al*., 2002; Wong & Benson, 2006).[8] The findings from qualitative research provide insightful information through a microscopic view of what takes place in the classroom where L2 teachers use CALL technology. However, they are limited to examining systematic change, if any, with regard to L2 teachers' use of computer technology pertaining to their prior experience of technology education, while taking into account other factors involved in teachers' use of computer technology.

Second, analytically, previous studies tend to regard L2 teachers' use of computer technology as a unitary construct – i.e., whether teachers use computer technology in the classroom (e.g., Egbert *et al*., 2002; Lam, 2000; Meskill *et al*., 2002; Wong & Benson, 2006). Teachers' use of computer technology in the classroom is multifaceted (Meskill *et al*., 2006a; O'Dwyer *et al*., 2004, 2005). To regard it as a unitary construct can give us a general picture illustrating teachers' technology integration. However, it would create analytical constraints in cases where teachers use computer technology for different instructional purposes. Some teachers, for instance, may use computer technology to deliver their instruction, some to engage students in creating products, and some others to encourage students' use of computer technology during class time. Deconstructing teachers' uses of computer technology allows for a discernible point of view in fathoming L2 teachers' use of computer technology in relation to their prior technology education experience.

In addition, there is a predominance of descriptive studies in the literature (e.g., Meskill *et al*., 2006a; Moore *et al*., 1998; Olsen, 1980) that delineate teachers' use of computer technology and their technology education experience. For instance, they inform us about teachers' preference for technology for their instructional purposes, teachers' formal technology education experience, and simple correlations between

[8] Echoing the views of other researchers in the field of educational technology, Coley (1997) called for rigorous methodological approaches in research investigating teachers' integration of technology.

variables such as teachers' attitude and technology use. And yet, given the multi-dimensional aspects of the process of teachers' integration of computer technology into the classroom, findings based on descriptive analysis are not sufficient to indicate any systematic relationship between factors involved in teachers' use of computer technology in the classroom. Previous studies also address contextual factors in relation to L2 teachers' integration of technology into the classroom. They tend to consider the availability and accessibility of technology infrastructure and resources in the school as additional factors related to teachers' use of computer technology (e.g., Egbert *et al*., 2002; Lam, 2000). While previous studies also point out the importance of non-material workplace conditions, such as support from school administrators and availability of technicians (e.g., Egbert *et al*., 2002; Lam, 2000; Meskill *et al*., 2006b), little systematic attention has been paid to the general technology climate in schools (e.g., L2 teachers' overall technology use and their overall technology education experience) in relation to teachers' use of computer technology in the classroom.

Finally, in terms of the research context, most studies are focused on a small number of pre- or in-service L2 teachers taking a technology course during (or after) the offered technology course, or on L2 teachers in one or two schools, rather than teachers in different schools across different school districts (e.g., Egbert *et al*., 2002; Lam, 2000; Meskill *et al*., 2002; Olesova & Meloni, 2006). Focusing on a small number of teachers during or after a formal technology education course is meaningful because it can show the efficacy of specifically designed courses. Furthermore, focusing on one or two schools informs other L2 researchers and teacher educators about dealing with context-specific problems with integrating computer technology. Findings from these studies, however, can be circumscribed by sample-specific and context-specific constraints, thereby hindering a more generalized account of whether L2 teachers with more, high quality, technology education are more likely to use computer technology in their classrooms.

In future studies, these limitations could be addressed if L2 researchers were to complement the findings of qualitative research through large-scale quantitative research, focusing on a systematic investigation of the relationship between the factors influencing L2 teachers' integration of technology. The notion of L2 teachers' use of computer technology in the classroom needs to be considered as being multi-faceted (i.e., different uses of computer technology for different instructional purposes), rather than a single generic construct (i.e., mere focus on whether to use computer technology or not). To ensure the fullest possible coverage of contextual factors in relation to teachers' integration of technology, more studies need to examine "non-material conditions" rather than "material conditions" (Pelgrum, 2001: 173).[9] To extend the research context with regard to L2 teachers' technology

[9] Compared to the number of studies on L2 teachers' individual factors and their technology integration, there are relatively few research studies that look into contextual factors in this context. Most existing studies on contextual factors have tended to be concerned with "material conditions" – e.g., technology infrastructure and accessibility to a computer lab – rather than "non-material conditions" – e.g., school climate of computer technology and administrative support (Pelgrum, 2001: 173). Nonetheless, several studies suggest the importance of non-material conditions in relation to L2 teachers' technology integration. For

integration, more efforts need to be made to look into L2 teachers working across different schools and their use of computer technology in the classroom.

Based on the synthesized findings of this study (i.e., the spherical model) future studies on CALL teacher education need to address both the above-listed limitations and the primary question that L2 researchers and teacher educators pursue (i.e., do L2 teachers use computer technology in the classroom?). Specifically, future research on L2 teachers' integration of technology into the classroom needs to examine the following issues in methodologically more rigorous and analytically more systematic ways: (1) With regard to the multi-faceted aspects of L2 teachers' use of computer technology, are teachers with more, high quality technology education experience likely to use computer technology more frequently in the classroom, even after taking into account individual and contextual factors? (2) How much and what kinds of technology education do L2 teachers need in order to use computer technology in the classroom more frequently? (3) Do "non-material conditions" of contextual factors (e.g., L2 teachers' overall technology education experience at the school level and overall attitudes towards using technology among L2 teachers within a school) influence L2 teachers' use of computer technology in the classroom? – that is, do teachers working in a technology-friendly environment use computer technology in the classroom more frequently?

Finally, the milieu of L2 education has changed prodigiously from the time when CALL was in its infancy (Olsen, 1980) to the present day, when more and more classrooms are being equipped with digital applications and ICT (Meskill *et al.*, 2006a). As several researchers have noted, teachers' lack of technology integration in the classroom is not necessarily due to the availability and accessibility of computer technology in the classroom, but rather due to the "incompatibility between the goals of education and interactions between teachers, students, educational and informational resources, and curricular goals and materials" (Levin & Wadmany, 2008: 235). Given the mediating role of L2 teachers in the technology-enhanced classroom, CALL technology education for L2 teachers is essential in order to overcome such incompatibility.

## References

Arnold, N., Ducate, L. and Lomicka, L. (2007) Virtual communities of practice in teacher education. In: Kassen, M. A., Lavine, R. Z., Murphy-Judy, K. and Peters, M. (eds.), *Preparing and developing technology-proficient L2 teachers*. San Marcos, TX: CALICO, 103–132.

Bauer-Ramazani, C. (2006) Training CALL teachers online. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 183–200.

Beatty, K. (2003) *Teaching and researching Computer-assisted Language Learning*. London: Pearson Education.

*(F'note continued)*

example, Robb and Susser (2006) suggest the influence of colleagues with regard to L2 teachers' software selection and use. Hong and Samimy (2009) examine the relationship between the school climate of computer technology among L2 teachers and their use of computer technology in the classroom.

Becker, H. J. (1994) How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education*, **26**(3): 291–321.

Blin, F. (2004) CALL and the development of learner autonomy: Towards an activity-theoretical perspective. *ReCALL*, **16**(2): 377–395.

Chao, C. (2006) How WebQuests send technology to the background: Scaffolding EFL teacher professional development in CALL. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 221–234.

Chapelle, C. A. (2001) *Computer applications in second language acquisition: Foundations for teaching, testing and research*. Cambridge: Cambridge University Press.

Chin, S. and Hortin, J. A. (1994) Teachers' perceptions of instructional technology and staff development. *Journal of Educational Technology Systems*, **22**(2): 83–98.

Christensen, R. (2002) Effects of technology integration education on the attitudes of teachers and students. *Journal of Research on Technology in Education*, **34**(4): 411–433.

Chun, D. M. and Plass, J. L. (1996) Effects of multimedia annotations on vocabulary acquisition. *Modern Language Journal*, **80**(2): 183–198.

Coley, R. (1997) Technology's impact. *Electronic school*. http://www.electronic-school.com/0997f2003.html.

Cuban, L. (2001) *Oversold & underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.

Davies, G. (2003) Perspectives on offline and online training initiatives. In: Felix, U. (ed.), *Language learning online: Towards best practice*. Lisse: Swets & Zeitlinger, 193–214.

Debski, R. (2006) Theory and practice in teaching project-oriented CALL. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 99–114.

Desjardins, F. and Peters, M. (2007) Single-course approach versus a program approach to develop technological competence in preservice language teachers. In: Kassen, M. A., Lavine, R. Z., Murphy-Judy, K. and Peters, M. (eds.), *Preparing and developing technology-proficient L2 teachers*. San Marcos, TX: CALICO, 3–21.

Ducate, L. C. and Lomicka, L. L. (2005) Exploring the Blogosphere: Use of web logs in the foreign language classroom. *Foreign Language Annals*, **38**(3): 410–421.

Egbert, J. (2006) Learning in context: Situating language teacher learning in CALL. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 167–181.

Egbert, J., Paulus, T. M. and Nakamichi, Y. (2002) The impact of CALL instruction on classroom computer use: A foundation for rethinking technology in teacher education. *Language Learning & Technology*, **6**(3): 108–126.

Gillingham, M. G. and Topper, A. (1999) Technology in teacher preparation: Preparing teachers for the future. *Journal of Technology and Teacher Education*, **7**(4): 303–321.

Godwin-Jones, R. (2002) Technology for prospective language teachers. *Language Learning & Technology*, **6**(3): 10–14.

Godwin-Jones, R. (2003) Blogs and Wikis: Environments for on-line collaboration. *Language Learning & Technology*, **7**(2): 12–16.

Grenfell, M., Kelly, M. and Jones, D. (2003) *The European language teacher: Recent trends and future developments in teacher education*. Oxford: Peter Lang.

Hanson-Smith, E. (2006) Communities of practice for pre- and in-service teacher education. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 301–315.

Hargrave, C. and Hsu, Y. (2000) Survey of instructional technology courses for preservice teachers. *Journal of Technology and Teacher Education*, **8**(4): 303–314.

Hegelheimer, V. (2006) When the technology course is required. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 117–133.

Hernández-Ramos, P. (2005) If not here, where? Understanding teachers' use of technology in Silicon Valley schools. *Journal of Research on Technology in Education*, **38**(1): 39–64.

Hong, K. H. and Samimy, K. K. (2009) The influence of school climate on L2 teachers' use of computer technology. *Studies in Foreign Language Education*, **23**(1): 227–258.

Hong, K. H. and Samimy, K. K. (forthcoming, 2010) The influence of L2 teachers' use of CALL modes on language learners' reactions to Blended Learning. *CALICO Journal*, **27**(2).

Hoven, D. (2007) The affordances of technology for student teachers to shape their teacher education experience. In: Kassen, M. A., Lavine, R. Z., Murphy-Judy, K. and Peters, M. (eds.), *Preparing and developing technology-proficient L2 teachers*. San Marcos, TX: CALICO, 133–163.

Hubbard, P. (2004) Learner training for effective use of CALL. In: Fotos, S. and Browne, C. M. (eds.), *New perspectives on CALL for second language classrooms*. Mahwah, NJ: LEA, 45–67.

Hubbard, P. (2008) CALL and the future of language teacher education. *CALICO Journal*, **25**(2): 175–188.

Hubbard, P. and Levy, M. (2006a) The scope of CALL education. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 2–20.

Hubbard, P. and Levy, M. (eds.) (2006b) *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company.

Hughes, J. (2005) The role of teacher knowledge and learning experiences in forming technology-integrated pedagogy. *Journal of Technology and Teacher Education*, **13**(2): 277–302.

Johnson, K. E. (1996) The role of theory in L2 teacher education. *TESOL Quarterly*, **30**(4): 765–771.

Jones, C. M. and Youngs, B. L. (2006) Teacher preparation for online language instruction. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 267–280.

Kamhi-Stein, L. D. (2000) Looking to the future of TESOL teacher education: Web-based bulletin board discussions in a methods course. *TESOL Quarterly*, **34**(3): 422–455.

Kassen, M. A. and Higgins, C. J. (1997) Meeting the technology challenge: Introducing teachers to language-learning technology. In: Bush, M. D. and Terry, R. M. (eds.), *Technology-enhanced language learning*. Lincolnwood, IL: NTC, 263–285.

Kassen, M. A., Lavine, R. Z., Murphy-Judy, K. and Peters, M. (eds.) (2007) *Preparing and developing technology-proficient L2 teachers: CALICO Monograph Series Volume 6*. San Marcos, TX: Computer Assisted Language Institution Consortium (CALICO).

Kern, R. (1995) Restructuring classroom interaction with networked computers: Effects on quality and characteristics of language production. *Modern Language Journal*, **79**(4): 457–476.

Kern, R., Ware, P. and Warschauer, M. (2004) Crossing frontiers: New directions in online pedagogy and research. *Annual Review of Applied Linguistics*, **24**: 243–260.

Kessler, G. (2006) Assessing CALL teacher training: What are we doing and what could we do better? In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 23–42.

Kessler, G. (2007) Formal and informal CALL preparation and teacher attitude toward technology. *Computer Assisted Language Learning*, **20**(2): 173–188.

Kolaitis, M., Mahoney, M. A., Pomann, H. and Hubbard, P. (2006) Training ourselves to train our students for CALL. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 317–332.

Lam, Y. (2000) Technophilia vs. technophobia: A preliminary look at why second language teachers do or do not use technology in their classrooms. *Canadian Modern Language Review*, **56**(3): 389–420.

Lawless, K. A. and Pellegrino, J. W. (2007) Professional development in integrating technology into teaching and leaning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research*, **77**(4): 575–614.

Levin, T. and Wadmany, R. (2008) Teachers' views on factors affecting effective integration of information technology in the classroom: Developmental scenery. *Journal of Technology and Teacher Education*, **16**(2): 233–263.

Levy, M. (1997) A rationale for teacher education and CALL: The holistic view and its implications. *Computer and the Humanities*, **30**: 293–302.

Levy, M. and Stockwell, G. (2006) *CALL dimensions: Options and issues in Computer-Assisted Language Learning*. New York: Lawrence Erlbaum Associates.

Luke, C. L. and Britten, J. S. (2007) The expanding role of technology in foreign language teacher education programs. *CALICO Journal*, **24**(2): 253–267.

Meskill, C., Anthony, N., Hilliker-VanStrander, S., Tseng, C.-H. and You, J. (2006a) CALL: A survey of K-12 ESOL teacher uses and preferences. *TESOL Quarterly*, **40**(2): 439–451.

Meskill, C., Anthony, N., Hilliker-VanStrander, S., Tseng, C. and You, J. (2006b) Expert-novice teacher mentoring in language learning technology. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 283–298.

Meskill, C., Mossop, J., DiAngelo, S. and Pasquale, R. K. (2002) Expert and novice teachers talking technology: Precepts, concepts, and misconcepts. *Language Learning & Technology*, **6**(3): 46–57.

Mishan, F. (2005) *Designing authenticity into language learning materials*. Bristol: Intellect.

Moore, Z., Morales, B. and Carel, S. (1998) Technology and teaching culture: Results of a state survey of foreign language teachers. *CALICO Journal*, **15**(1–3): 109–128.

Mumtaz, S. (2000) Factors affecting teachers' use of information and communications technology: A review of the literature. *Journal of Information Technology for Teacher Education*, **9**(3): 319–341.

Norris, C., Sullivan, T., Poirot, J. and Soloway, E. (2003) No access, no use, no impact: Snapshot surveys of educational technology in K-12. *Journal of Research on Technology in Education*, **36**(1): 15–27.

O'Dwyer, L. M., Russell, M. and Bebell, D. (2004) Identifying teacher, school and district characteristics associated with elementary teachers' use of technology: A multilevel perspective. *Education Policy Analysis Archives*, **12**(48) http://epaa.asu.edu/epaa/v12n48.

O'Dwyer, L. M., Russell, M. and Bebell, D. (2005) Identifying teacher, school, and district characteristics associated with middle and high school teachers' use of technology: A multilevel perspective. *Journal of Educational Computing Research*, **33**(4): 369–393.

Olesova, L. and Meloni, C. F. (2006) Designing and implementing collaborative Internet projects in Siberia. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 237–249.

Olsen, S. (1980) Foreign language departments and computer-assisted instruction: A survey. *Modern Language Journal*, **64**(3): 341–349.

Oxford, R. L. and Jung, S. (2007) National guidelines for technology integration in TESOL programs: Factors affecting (non)implementation. In: Kassen, M. A., Lavine, R. Z.,

Murphy-Judy, K. and Peters, M. (eds.), *Preparing and developing technology-proficient L2 teachers*. San Marcos, TX: CALICO, 23–48.

Parsad, B. and Jones, J. (2006) Internet access in US public schools and classrooms: 1994–2003. *Educational Statistics Quarterly*, **7**(1 & 2). http://nces.ed.gov/programs/quarterly/vol_7/1_2/4_3.asp

Partridge, J. (2006) Matching language and IT skills. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 63–79.

Pelgrum, W. J. (2001) Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & Education*, **37**(2): 163–178.

Penuel, W. R. (2006) Implementation and effects of one-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education*, **38**(3): 329–348.

Peters, M. (2006) Developing computer competencies for pre-service language teachers: Is one course enough? In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 153–165.

Rickard, A., Blin, F. and Appel, C. (2006) Training for trainers: Challenges, outcomes, and principles of in-service training across the Irish education system. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 203–218.

Robb, T. N. (2006) Helping teachers to help themselves. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 335–347.

Robb, T. N. and Susser, B. (2006) The life and death of software: Examining the selection process. *CALICO Journal*, **18**(1): 41–52.

Russell, M., Bebell, D., O'Dwyer, L. M. and O'Connor, K. (2003) Examining teacher technology use: Implications for preservice and inservice teacher preparation. *Journal of Teacher Education*, **54**(4): 297–310.

Scheffler, F. L. and Logan, J. P. (1999) Computer technology in schools: What teachers should know and be able to do. *Journal of Research on Computing in Education*, **31**(3): 305–326.

Slaouti, D. and Motteram, G. (2006) Reconstructing practice: Language teacher education and ICT. In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 81–97.

Stockwell, G. and Levy, M. (2001) Sustainability of email interactions between native speakers and nonnative speakers. *Computer Assisted Language Learning*, **14**(5): 419–442.

Szendeffy, J. D. (2005) *A Practical guide to using computers in language teaching*. Ann Arbor: University of Michigan Press.

Technology in Schools Task Force (2003) *Suggestions, tools, and guideline for assessing technology in elementary and secondary education*. National Center for Education Statistics. http://nces.ed.gov/pubs2003/tech_schools/chapter7.asp.

Thorne, S. L. and Payne, J. S. (2005) Evolutionary trajectories, Internet-mediated expression, and language education. *CALICO Journal*, **22**(3): 371–397.

Tochon, F. V. and Black, N. J. (2007) Narrative analysis of electronic portfolios: Preservice teachers' struggles in researching Pedagogically Appropriate Technology Integration (PATI). In: Kassen, M. A., Lavine, R. Z., Murphy-Judy, K. and Peters, M. (eds.), *Preparing and developing technology-proficient L2 teachers*. San Marcos, TX: CALICO, 295–320.

van Olphen, M. (2007) Digital portfolios: Balancing the academic and professional needs of world language teacher candidates. In: Kassen, M. A., Lavine, R. Z., Murphy-Judy, K. and Peters, M. (eds.), *Preparing and developing technology-proficient L2 teachers*. San Marcos, TX: CALICO, 265–294.

Warschauer, M. and Kern, R., (eds.) (2000) *Network-based language teaching: Concepts and Practice*. New York: Cambridge University Press.

Weikart, L. A. and Marrapodi, M. (1999) The missing link: the technology infrastructure. *Computers in the Schools*, **15**(2): 49–60.

Wetzel, K. and Chisholm, I. (1998) An evaluation of technology integration in teacher education for bilingual and English as a second language education majors. *Journal of Research on Computing in Education*, **30**(4): 379–396.

White, C. (2006) Distance learning of foreign languages. *Language Teaching*, **39**(4): 247–264.

Wong, L. and Benson, P. (2006) In-service CALL education: What happens after the course is over? In: Hubbard, P. and Levy, M. (eds.), *Teacher education in CALL*. Philadelphia, PA: John Benjamins Publishing Company, 251–264.

Wozney, L., Venkatesh, V. and Abrami, P. C. (2006) Implementing computer technologies: Teachers' perceptions and practices. *Journal of Technology and Teacher Education*, **14**(1): 173–207.